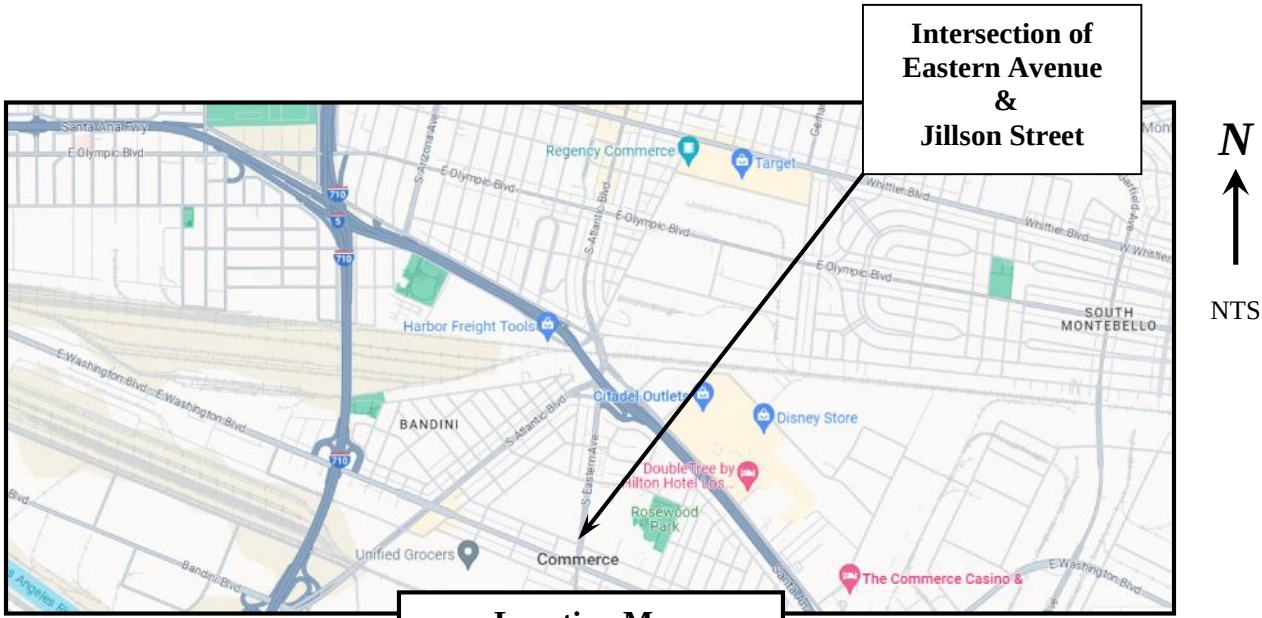
TRAFFIC CONTROL DEVICE WARRANTS ANALYSIS
FOR THE INTERSECTION OF
EASTERN AVENUE AND JILLSON STREET
IN THE
CITY OF COMMERCE, CA

INTRODUCTION

The City of Commerce requested Hartzog & Crabill, Inc. to complete a Traffic Control Device Warrants Analysis for the intersection of Eastern Avenue and Jillson Street. This analysis was completed in order to verify if a traffic signal or multiway stop sign installation is justified and recommended based on meeting standard guidelines.

The location is a 4-way intersection with Eastern Avenue running in the north-south directions and Jillson Street intersecting in the east-west directions. The intersection is located along the minor arterial roadway of Eastern Avenue, south of the I-5 Freeway, and just north of Washington Boulevard (*see Location Map below*). The intersection lies in the central area of the City of Commerce, entirely within City jurisdiction. At the present time, the intersection has a 2-way Stop sign installation controlling the Jillson Street approaches, while Eastern Avenue is uncontrolled.



Location Map

City of Commerce
Los Angeles County

BACKGROUND

Eastern Avenue is a north-south local collector roadway primarily with industrial and commercial properties on both sides of the street. At the intersection with Jillson Street, the roadway is approximately 84 feet wide curb-to-curb. The 2-lane roadway provides for one lane of traffic in each direction, which are separated by double-double-yellow centerline median striping, as well as a short, narrow median north of Jillson Street. There are also left-turn and right-turn lanes on each approach, as well as buffered bicycle lane striping on both sides of the roadway. The roadway does have curb, gutter, and sidewalk improvements on both sides. Eastern Avenue has a posted speed limit of 40 MPH. Near the intersection with Jillson Street, on-street parking is prohibited on both sides of the street via red curb and/or No Stopping Any Time signage. Currently, there are no STOP signs on Eastern Avenue (i.e., uncontrolled) at its intersection with Jillson Street.

See Exhibit 1 (next page) for photo images of Eastern Avenue.

Jillson Street is an east-west local roadway with primarily industrial properties on both sides of the street. At the 4-way intersection with Eastern Avenue, the roadway is approximately 40 feet wide. The 2-lane roadway provides for one lane of traffic in each direction, which are not separated by any striping. The roadway does have curb, gutter, and sidewalk improvements on both sides. Jillson Street does not have a posted speed limit; however, the residential nature of this street results in a local 'prima facie' speed limit of 25 MPH and does not require posting. On-street parking is primarily allowed on both sides, with certain segments prohibited via red curb and various signage. There is a STOP sign, a white 'STOP' pavement marking, and a limit line on each approach of Jillson Street at its intersection with Eastern Avenue.

See Exhibit 2 (following page) for photo images of Jillson Street.

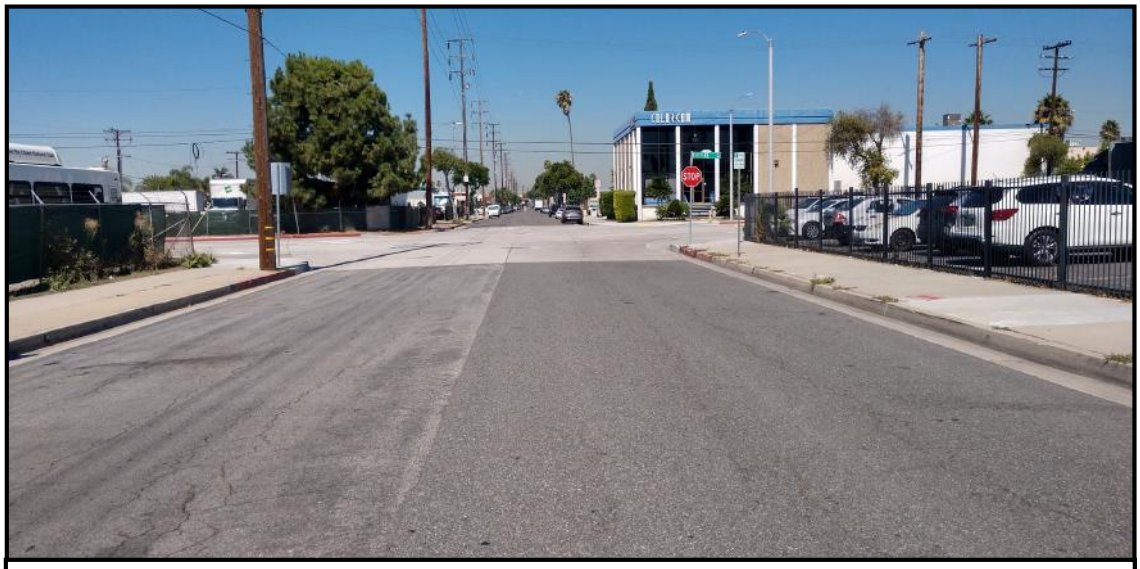
EXHIBIT 1

EASTERN AVENUE (*Looking Northbound*) at JILLSON STREET

EASTERN AVENUE (*Looking Southbound*) at JILLSON STREET

EXHIBIT 2

JILLSON STREET (*Looking Eastbound*) at EASTERN AVENUE



JILLSON STREET (*Looking Westbound*) at EASTERN AVENUE

TRAFFIC SIGNAL WARRANTS ANALYSIS

As is common practice with many municipal agencies, the City of Commerce has an adopted practice for using State guidelines as reference standards in order to provide uniformity and consistency in terms of traffic control. Therefore, the prevailing source that addresses these topics was used for this analysis, which is the State of California Manual of Uniform Traffic Control Devices (*California MUTCD*). The California MUTCD contains minimum guidelines regarding traffic volumes, collisions, speeds, visibility, and other criteria in order to satisfy the requirements, in this case, for the recommendation and installation of a traffic signal or multiway stop. HCI will begin with a traffic signal analysis, followed by the multiway stop analysis.

The traffic signal guidelines in Chapter 4C. Traffic Control Signal Needs Studies of the California MUTCD are included in Appendix A.

As stated in these California MUTCD guidelines, as well as noted below, signalization should be considered when the following **Standard** is met:

"An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether the installation of a traffic control signal is justified at a particular location. The investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in the following traffic signal warrants and other factors related to existing operation and safety at the study location:

Warrant 1, Eight-Hour Vehicular Volume.
Warrant 2, Four-Hour Vehicular Volume.
Warrant 3, Peak Hour.
Warrant 4, Pedestrian Volume.
Warrant 5, School Crossing.
Warrant 6, Coordinated Signal System.
Warrant 7, Crash Experience.
Warrant 8, Roadway Network
Warrant 9, Inters. Near a Grade Crossing

In other words, in order to *justify and recommend* the installation of traffic control signals, as shown above there are nine (9) California MUTCD Traffic Signal Warrants that should be analyzed. If any one, or a combination, of these warrants is met then a traffic signal should be considered. Yet, as also stated in the California MUTCD: *"The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal."*

TRAFFIC SIGNAL WARRANTS ANALYSIS (*continued*)

Traffic volume data and collision history provide a good overall picture of intersection characteristics; hence, these are the conditions first reviewed by HCI in completing traffic signal warrant analyses. Accordingly, the following analysis has focused on volume and collision data to determine if a traffic signal is warranted at the intersection of Eastern Avenue and Jillson Street. However, all applicable traffic signal warrants and other factors such as restricted sight distance were included. It should be noted, if the warrant criteria in these guidelines are not met, the installation of an un-warranted traffic signal is typically not recommended.

Traffic Volumes

HCI collected Average Daily Traffic (ADT) vehicular approach counts to the intersection on Wednesday, August 23, 2023 in order to account for vehicles that typically use this 4-way intersection. The ADT bi-directional count for Eastern Avenue is 12,830 vehicles per day with the highest AM peak-hour bi-directional volume having 841 vehicles, and 1,044 vehicles in the PM peak-hour. The ADT directional approach count for Jillson Street is 1,874 vehicles with the highest AM peak-hour bi-directional volume having 165 vehicles, and 160 vehicles in the PM peak-hour. Table 1 (below) provides a breakdown of the approach volumes.

TABLE 1
24-HOUR INTERSECTION APPROACH VEHICLE COUNTS
AND HIGHEST HOURLY VOLUMES

Street	Direction	ADT Volume	Directional Split	Highest Hourly Volume
Eastern Avenue	Northbound	5,331	42%	468 (4 – 5 PM)
	Southbound	7,499	58%	589 (5 – 6 PM)
Jillson Street	Eastbound	916	49%	86 (12 – 1 PM)
	Westbound	958	51%	85 (7 – 8 AM)

The traffic volume data collected for this intersection is included in Appendix B.

TRAFFIC SIGNAL WARRANTS ANALYSIS *(continued)*

HCI also collected 4-Hour Peak-Hour Turning Movement Counts for the intersection, including pedestrians and bicycles, on Wednesday, August 23, 2023, and incorporated in the Appendix.

Eastern Avenue is considered the 'through' or 'major' street at this industrial/commercial 4-way intersection, since it carries higher volumes from both approaches, and drivers are not required to slow down, or even stop, before proceeding straight through the intersection. In comparison, Jillson Street is considered the 'minor' street as drivers on Jillson Street are required to stop at Eastern Avenue and look both ways before proceeding to make a left-turn, right-turn, or proceed straight.

It is typically expected that the traffic volumes on the minor street are significantly less than those on the major street. As can be seen from the table above, this is the case, as Jillson Street carries approximately 13% of the entire traffic entering the intersection (Eastern Avenue carries 87% of entering traffic).

A part of the California MUTCD guideline criteria also calls for a reduction in the required minimum volumes when the critical approach speed (*or 85th-percentile speed*) on the major street exceeds 40 MPH. If this is the case, the minimum vehicular volumes to be met for a multiway stop sign installation are reduced to 70%. As the posted speed limit is 40 MPH and generally the 85th percentile speed is higher than the posted speed limit, the 70% minimum volumes are considered applicable for this analysis.

All traffic count and speed data gathered for this intersection were applied to the Traffic Signal Warrants Worksheets for the Traffic Volume Warrants #1, #2, and #3. The existing intersection traffic volume data did meet the minimum traffic volumes required for Warrants #1b, 2, and 3. Consequently, the first three warrants <u>are satisfied</u> for signalization.

TRAFFIC SIGNAL WARRANTS ANALYSIS (*continued*)

Collision History

The guidelines for traffic signalization contained in the California MUTCD regarding collisions, or crashes, require a minimum of five (5) reported crashes occurring in a 12-month period that are susceptible to correction by a traffic signal in order to satisfy this warrant. Such crashes include right-turn and left-turn type collisions, as well as Broadside, Head-on, and Pedestrian-Vehicle collisions. Other types of collisions categorized as 'Sideswipe', 'Rear-End', and 'Hit Object' are generally not considered correctible, unless otherwise indicated. The latest available intersection collision history data was gathered by HCI from the State of California Highway Patrol (CHP) Statewide Integrated Traffic Records System website (*i*-SWITRS), which is where local jurisdictions report their collisions. A 5-year traffic collision history summary report was prepared from this data ***(see Appendix C attached).*** Table 2 (below) provides the most recent collision summary occurring at or near this intersection.

TABLE 2
SWITRS COLLISION SUMMARY

Intersection	2018		2019		2020-21		2022 – Sep. 2023	
	Date	**Type of Coll. / Correctible?**	**Date**	**Type of Coll. / Correctible?**	**Date**	**Type of Coll. / Correctible?**	**Date**	**Type of Coll. / Correctible?**
Eastern Avenue at Jillson Street	**02/23**	**Broadside / Yes**	03/28	Sideswipe / No	**03/05/20**	**Broadside / Yes**	**05/01/22**	**Head On / Yes**
	03/01	Sideswipe / No	**06/11**	**Broadside / Yes**	**06/22/20**	**Broadside / Yes**		
	03/29	**Broadside / Yes**	**07/24**	**Broadside / Yes**	09/21/20	-	01/10/23	Sideswipe / No
	05/23	**Broadside / Yes**	**08/07**	**Broadside / Yes**			03/07/23	Sideswipe / No
	07/23	**Broadside / Yes**	09/23	Rear-End / No	**11/09/21**	**Broadside / Yes**	**03/22/23**	**Broadside / Yes**
	07/29	*Not Suffic. Data*			11/30/21	Hit-Object / No	**04/21/23**	**Broadside / Yes**
	09/18	**Broadside / Yes**					05/18/23	Sideswipe / No
	11/16	**Broadside / Yes**					**06/29/23**	**Broadside / Yes**
							06/30/23	**Broadside / Yes**

Notes: Information above is derived per the latest 5-year intersection traffic collision database file gathered from CHP-SWITRS (*i-SWITRS website*).

1) Type of Coll. = Type of Collision (*i.e., broadside, rear-end, etc*.)
2) Correctible? = Yes / No

TRAFFIC SIGNAL WARRANTS ANALYSIS (*continued*)

Collision History (continued)

As shown above, there have been six (6) correctible reported collisions, in one year (2018), at or near this intersection over the past (5) years of available collision data. Since the collision warrant requires a minimum of (5) reported collisions susceptible to correction by a traffic signal to occur within a 12-month period, the collision warrant is considered satisfied. It should be noted that a majority of the collisions involved an eastbound or westbound vehicle on Jillson Street colliding with a northbound or southbound vehicle on Eastern Street.

Visibility

Impaired visibility, or restricted sight distance, due to the geometry of the intersection and possible obstructions was carefully considered during our field-review of the surrounding industrial/commercial environment. The geometry of the intersection includes an angle that is slightly off of a 90° angle. In addition, Eastern Avenue has a consistent, very gradual incline in the northbound direction. Jillson Street is primarily flat as it intersects with Eastern Avenue.

A driver's sight distance was measured from the side-street approaches to the intersection, as eastbound and westbound traffic on Jillson Street is required to stop, and look both ways, before proceeding to make a left-turn, right-turn onto Eastern Avenue, or proceed straight. The measured distance was derived from the stopping sight distance guidelines found in the California MUTCD ***(see Appendix D)***. In this reference, a 40 MPH roadway speed recommends a minimum Stopping Sight Distance of 305 feet. However, the 85th percentile speeds typically exceed the posted speed limit. Therefore, a 45 MPH speed limit was used as a more conservative measure, which has a minimum sight distance of 360 feet. This distance was used looking towards approaching, uncontrolled traffic along Eastern Avenue. More specifically, this stopping sight distance was field-measured from a typical 'stopped' vehicle location on Jillson Street at the intersection looking towards the oncoming lanes of cross-traffic on Eastern Avenue. An orange cone was placed at this distance and a photograph was taken from a stopped driver's perspective (i.e, approximately 3.5 feet in height).

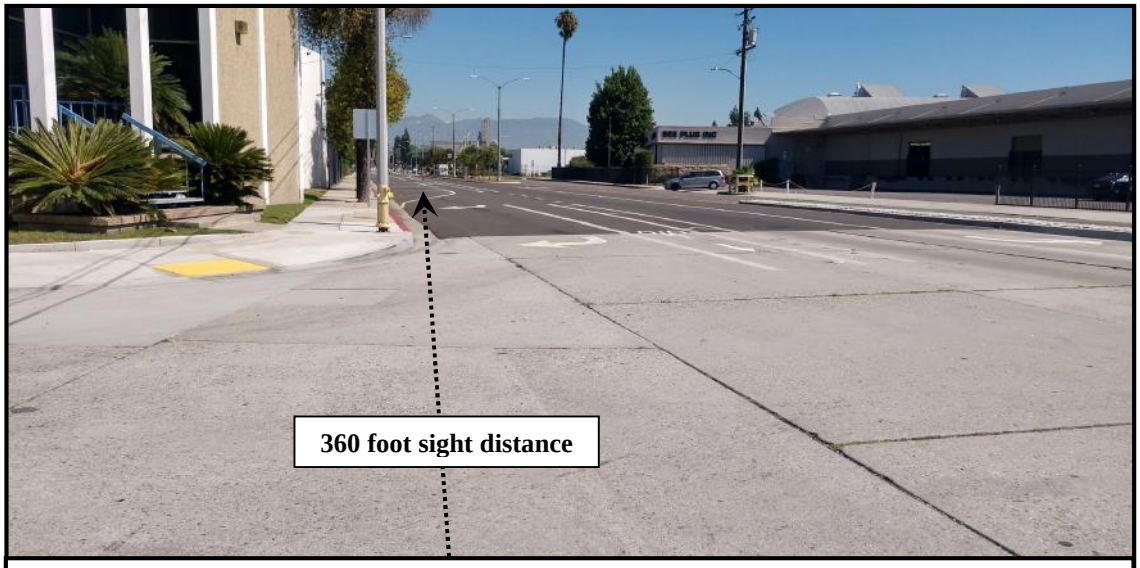
(***See sight distance photos in Exhibits 3 - 4 on the following pages***).

EXHIBIT 3

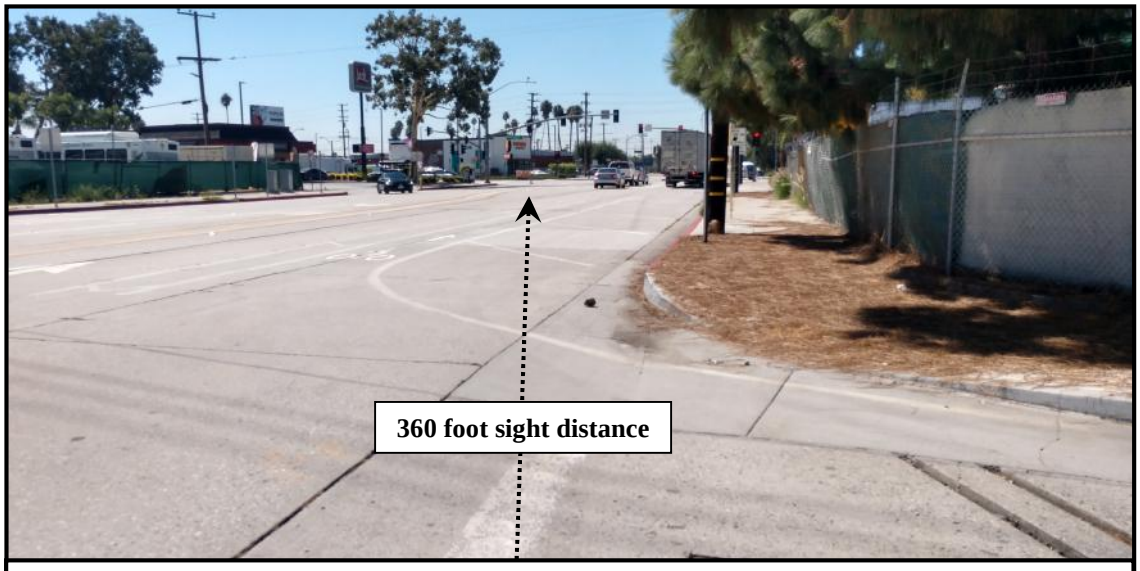
East Side JILLSON STREET (*Looking Northerly*) @ EASTERN AVENUE

East Side JILLSON STREET (*Looking Southerly*) @ EASTERN AVENUE

EXHIBIT 4



West Side JILLSON STREET (*Looking Northerly*) @ EASTERN AVENUE



West Side JILLSON STREET (*Looking Southerly*) @ EASTERN AVENUE

TRAFFIC SIGNAL WARRANTS ANALYSIS (*continued*)

Visibility (continued)

As Exhibits 3 - 4 show, when looking from Jillson Street, a stopped driver does have a clear line of sight of at least 360 feet looking both ways onto Eastern Avenue.

Other Considerations

As noted in the California MUTCD, *"The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal."* An example of where it may not be appropriate to install a traffic signal is if the traffic signal is too close to another traffic signal such that it may result in additional congestion. In these cases, it would be appropriate to identify other measures and apply engineering judgment to determine the most appropriate measure to implement.

As a rule of thumb, the recommended minimum spacing between traffic signals is 600 feet, which greatly reduces the likelihood of vehicles queues backing up to the prior intersection and unintentionally blocking it, and thereby, create additional congestion. For this particular case, Jillson Street is located approximately 340 feet (as measured centerline to centerline) from Washington Boulevard, which is a six-lane Major Arterial highway. Due to the close proximity of Washington Boulevard to Jillson Street, there may be occasions where traffic on northbound Eastern Avenue may be stopped at a red light at Jillson Street and be backed up to Washington Boulevard and end up blocking the intersection. These concerns are most prominent during the weekday AM and PM peak periods.

An alternate measure to installing a traffic signal would be to restrict Jillson Street to a right-turn movement only. Correspondingly, the left-turn and through movements would be prohibited on Jillson Street. It is anticipated that this measure would improve safety at the intersection. With this measure, drivers on Jillson Street would only need to watch for traffic coming from one direction on Eastern Avenue instead of both directions. As noted above, a majority of the collision involved a vehicle on Jillson Street colliding with a vehicle on Eastern Avenue.

TRAFFIC SIGNAL WARRANTS ANALYSIS (*continued*)

Other Considerations (continued)

After making the right turn from Jillson Street onto Eastern Avenue, drivers can then make a U-turn at the next intersection at Washington Boulevard or Harbor Street. Alternately, drivers can decide to cross Eastern Avenue at Washington Boulevard, which parallels Jillson Street approximately 340 feet to the south.

All completed California MUTCD Traffic Signal Warrant Worksheets can be found in Appendix E.

MULTIWAY STOP WARRANTS ANALYSIS

As mentioned above, the intersection data gathered for this intersection did satisfy the warrants for traffic signalization. However, to provide the City with the overall data, a multiway stop application is still considered in this section of the analysis. The California MUTCD Multiway Stop Applications Guidance criteria are described in the following four main parts:

1) As an interim measure where traffic control signals are justified;

2) Reported crashes – five or more in a 12-month period that are susceptible to correction;

3) Traffic and pedestrian volumes, speeds, and delay; and

4) Where a combination of the above criteria are satisfied to 80 percent.

If any one, or a combination, of the above criteria is met, then a multiway stop application should be considered. If these criteria are not met, the installation of an unwarranted stop sign installation is typically not recommended.

The California MUTCD STOP Sign and Multiway Stop Applications guidelines are included in Appendix F.

MULTIWAY STOP WARRANTS ANALYSIS (*continued*)

The California MUTCD Multiway Stop Applications section contains similar guidelines, such as minimum collisions and traffic volumes necessary for the justification of a multiway stop control. The general guidelines given for a stop sign application begin with using engineering judgment for the installation of a stop sign(s) on a street entering a through-highway and/or where high speeds, restricted view, or crash records indicate a need for control by a stop sign. Further guidance criteria found in the California MUTCD include the following important statements: ***"STOP signs should not be used for speed control… STOP signs should be installed in a manner that minimizes the numbers of vehicles having to stop… In most cases, the street carrying the lowest volume of traffic should be stopped… A STOP sign should not be installed on the major street unless justified by a traffic engineering study… Multiway stop control is used where the volume of traffic on the intersecting roads is approximately equal."***

Interim Measure for a Traffic Signal

It has been shown in the above traffic signal analysis that a traffic control signal is warranted.

Collision History

As also shown in the above traffic signal analysis, there have been six (6) reported correctible collisions during one year (2018) at this particular intersection during the past five (5) years. Therefore, the Reported Crashes criteria for a multiway stop installation is satisfied, as the five (5) minimum correctible reported crashes in a 12-month period were met for this intersection.

Traffic Volumes

The above traffic signal analysis showed that the traffic volumes on the minor street are considerably less than those on the major street. A part of the California MUTCD Guidance criteria also calls for a change in minimum volumes required for a multiway stop when the critical approach speed (*or 85th-percentile speed*) on the major street exceeds 40 MPH. As mentioned, since the 85th percentile speeds are generally higher than the posted speed, the minimum vehicular volumes to be met for a multiway stop installation are reduced to 70%, and also evaluated/shown on next page.

MULTIWAY STOP WARRANTS ANALYSIS (*continued*)

Traffic Volumes (*continued*)

It is important to note that the hourly vehicle traffic counts shown in Table 1 above are given for the highest hours of traffic, and serve as a good indicator to compare with the required traffic volumes in the California MUTCD multiway stop warrant. In this case, they indicate that they may satisfy the 70% minimum volume guidelines. The average hourly minimum volumes for a multiway stop application *[300 vehicles per hour (or 210 using 70%) from both approaches on the major street)* are to be satisfied for **each** of eight (8) hours of an average day. Tables 3 and 4 below show the California MUTCD minimum volume guidelines for a Multiway Stop Application (*100% and 70%, respectively*) in comparison with the highest hourly traffic count data. It should be noted that both Parts 1 and 2 of the minimum volume warrants below must be satisfied in order to fulfill either of these traffic volume warrants.

TABLE 3
MULTIWAY STOP SIGN WARRANT FOR MINIMUM TRAFFIC VOLUMES
EASTERN AVENUE AT JILLSON STREET

Part 1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least **300** vehicles per hour for any (**8**) hours of an average day,	***and***	**Part 2.** The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least **200** units per hour for the same (**8**) hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour,	***but***	**Part 3.** If the 85th-percentile approach speed of the major-street traffic exceeds 65 km/h or exceeds 40 mph, the minimum vehicular volume warrants are (**70**) percent of the above values.
Results: **Yes, average (857) vehicles per hour** **Meets 100% of required average hourly traffic volume**		**Results:** **No, average (142) vehicles per hour** **Meets only 71% of required average hourly traffic volumes**		**Results:** **Yes, 85th higher.** ***Review 70% table below, also***

TABLE 4
MULTIWAY STOP SIGN WARRANT FOR MINIMUM TRAFFIC VOLUMES *(REDUCED TO 70%)*

Part 1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least **210** vehicles per hour for any (**8**) hours of an average day,	***and***	**Part 2.** The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least **140** units per hour for the same (**8**) hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour,
Results: **Yes, average (857) vehicles per hour** **Meets 100% of required average hourly traffic volume**		**Results:** **Yes, average (142) vehicles per hour** **Meets 100% of required average hourly traffic volumes**

MULTIWAY STOP WARRANTS ANALYSIS (*continued*)

Traffic Volumes (continued)

As shown above, when the applicable minimum volumes required are reduced to 70% due to speeds higher than 40 MPH, the average hourly intersection approach volumes do satisfy the required volumes (*100% major street / 100% minor street*). Since both parts must be met, the traffic volume warrant is considered satisfied for a multiway stop at the intersection of Eastern Avenue and Jillson Street.

However, as noted in the California MUTCD, *"Multiway stop control is used where the volume of traffic on the intersecting roads is approximately equal."* Based on a review of the traffic volumes, Jillson Street carries approximately 13% of the traffic; and Eastern Avenue carries approximately 87% of the traffic. Because of the large differential split in traffic volumes, the implementation of stop controls on Eastern Avenue would likely result in long queues on Eastern Avenue. For northbound Eastern Avenue, the queuing would begin at Jillson Street and extend back to and end up blocking Washington Boulevard. The implementation of a multiway stop would result in additional congestion on Eastern Avenue.

RECOMMENDATIONS

Based on the findings of this analysis, the intersection of Eastern Avenue and Jillson Street met warrants for a traffic signal as summarized below:

- The satisfaction of Traffic Signal Warrant #1b (Interruption of Continuous Traffic)
- The satisfaction of Traffic Signal Warrant #2 (Four-Hour Vehicular Volume)
- The satisfaction of Traffic Signal Warrant #3b (Peak Hour)
- The satisfaction of Traffic Signal Warrant #7 (Crash Experience)

RECOMMENDATIONS (*continued*)

In addition, the intersection met warrants for a multiway stop. However, because of its close proximity to the traffic signal at Washington Boulevard, the implementation of a traffic signal or multiway stop would likely result in additional congestion on Eastern Avenue. Northbound vehicles would be stopped at Jillson Street and would queue up to and block Washington Boulevard.

An alternate measure to installing a traffic signal or a multiway stop would be to restrict Jillson Street to a right-turn movement only. Correspondingly, the left-turn and through movements would be prohibited on Jillson Street. It is anticipated that this measure would improve safety at the intersection because drivers on Jillson Street would only need to watch for traffic coming from one direction on Eastern Avenue instead of both directions. As noted in the analysis, a majority of the collision involved a vehicle on Jillson Street colliding with a vehicle on Eastern Avenue.

Based on the warrant analysis and engineering judgment, it is recommended to restrict on Jillson Street to right-turn movement only onto Eastern Avenue. After making the right turn, drivers can then make a U-turn at Washington Boulevard or Harbor Street. Alternately, drivers can decide to cross Eastern Avenue at Washington Boulevard, which parallels Jillson Street approximately 340 feet to the south.

APPENDIX A

CALIFORNIA MUTCD

TRAFFIC CONTROL SIGNAL NEEDS STUDIES GUIDELINES:

CHAPTER 4C. TRAFFIC CONTROL SIGNAL NEEDS STUDIES

Section 4C.01 Studies and Factors for Justifying Traffic Control Signals

Standard:

01 **An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location.**

01a **On State highways, the engineering study shall include consideration of a roundabout (yield control). If a roundabout is determined to provide a viable and practical solution, it shall be studied in lieu of, or in addition to a traffic control signal.**

Guidance:

01b *On local streets and highways, the engineering study should include consideration of a roundabout (yield control). If a roundabout is determined to provide a viable and practical solution, it should be studied in lieu of, or in addition to a traffic control signal.*

Support:

01c Refer to Caltrans' website (http://www.dot.ca.gov/hq/traffops/liaisons/ice.html) for more information on the Traffic Operations Policy Directive 13-02, Intersection Control Evaluation (ICE), and other resources for the evaluation of intersection traffic control strategies.

02 **The investigation of the need for a traffic control signal shall include an analysis of factors related to the existing operation and safety at the study location and the potential to improve these conditions, and the applicable factors contained in the following traffic signal warrants:**

Warrant 1, Eight-Hour Vehicular Volume
Warrant 2, Four-Hour Vehicular Volume
Warrant 3, Peak Hour
Warrant 4, Pedestrian Volume
Warrant 5, School Crossing
Warrant 6, Coordinated Signal System
Warrant 7, Crash Experience
Warrant 8, Roadway Network
Warrant 9, Intersection Near a Grade Crossing

03 **The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.**

Support:

04 Sections 8C.09 and 8C.10 contain information regarding the use of traffic control signals instead of gates and/ or flashing-light signals at highway-rail grade crossings and highway-light rail transit grade crossings, respectively.

Guidance:

05 *A traffic control signal should not be installed unless one or more of the factors described in this Chapter are met.*

06 *A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.*

07 *A traffic control signal should not be installed if it will seriously disrupt progressive traffic flow.*

08 *The study should consider the effects of the right-turn vehicles from the minor-street approaches. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the signal warrants listed in Paragraph 2.*

09 *Engineering judgment should also be used in applying various traffic signal warrants to cases where approaches consist of one lane plus one left-turn or right-turn lane. The site-specific traffic characteristics should dictate whether an approach is considered as one lane or two lanes. For example, for an approach with one lane for through and right-turning traffic plus a left-turn lane, if engineering judgment indicates that it should be considered a one-lane approach because the traffic using the left-turn lane is minor, the total traffic volume approaching the intersection should be applied against the signal warrants as a one-lane approach. The*

approach should be considered two lanes if approximately half of the traffic on the approach turns left and the left-turn lane is of sufficient length to accommodate all left-turn vehicles.

10 *Similar engineering judgment and rationale should be applied to a street approach with one through/left-turn lane plus a right-turn lane. In this case, the degree of conflict of minor-street right-turn traffic with traffic on the major street should be considered. Thus, right-turn traffic should not be included in the minor-street volume if the movement enters the major street with minimal conflict. The approach should be evaluated as a one-lane approach with only the traffic volume in the through/left-turn lane considered.*

11 *At a location that is under development or construction and where it is not possible to obtain a traffic count that would represent future traffic conditions, hourly volumes should be estimated as part of an engineering study for comparison with traffic signal warrants. Except for locations where the engineering study uses the satisfaction of Warrant 8 to justify a signal, a traffic control signal installed under projected conditions should have an engineering study done within 1 year of putting the signal into stop-and-go operation to determine if the signal is justified. If not justified, the signal should be taken out of stop-and-go operation or removed.*

12 *For signal warrant analysis, a location with a wide median, even if the median width is greater than 30 feet, should be considered as one intersection.*

Option:

13 At an intersection with a high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher ~~of the major-street left-turn volumes as the "minor-street" volume and the corresponding single direction of opposing traffic on the major street as the "major-street" volume~~ volume of the major-street left-turn volumes plus the higher volume minor-street approach as the "minor street" volume and both approaches of the major street minus the higher of the major-street left-turn volume as "major street" volume.

14 For signal warrants requiring conditions to be present for a certain number of hours in order to be satisfied, any four sequential 15-minute periods may be considered as 1 hour if the separate 1-hour periods used in the warrant analysis do not overlap each other and both the major-street volume and the minor-street volume are for the same specific one-hour periods.

15 For signal warrant analysis, bicyclists may be counted as either vehicles or pedestrians.

Support:

16 When performing a signal warrant analysis, bicyclists riding in the street with other vehicular traffic are usually counted as vehicles and bicyclists who are clearly using pedestrian facilities are usually counted as pedestrians.

Option:

17 Engineering study data may include the following:

A. The number of vehicles entering the intersection in each hour from each approach during 12 hours of an average day. It is desirable that the hours selected contain the greatest percentage of the 24-hour traffic volume.
B. Vehicular volumes for each traffic movement from each approach, classified by vehicle type (heavy trucks, passenger cars and light trucks, public-transit vehicles, and, in some locations, bicycles), during each 15-minute period of the 2 hours in the morning and 2 hours in the afternoon during which total traffic entering the intersection is greatest.
C. Pedestrian volume counts on each crosswalk during the same periods as the vehicular counts in Item B and during hours of highest pedestrian volume. Where young, elderly, and/or persons with physical or visual disabilities need special consideration, the pedestrians and their crossing times may be classified by general observation.
D. Information about nearby facilities and activity centers that serve the young, elderly, and/or persons with disabilities, including requests from persons with disabilities for accessible crossing improvements at the location under study. These persons might not be adequately reflected in the pedestrian volume count if the absence of a signal restrains their mobility.
E. The posted or statutory speed limit or the 85th-percentile speed on the uncontrolled approaches to the location.
F. A condition diagram showing details of the physical layout, including such features as intersection geometrics, channelization, grades, sight-distance restrictions, transit stops and routes, parking conditions,

pavement markings, roadway lighting, driveways, nearby railroad crossings, distance to nearest traffic control signals, utility poles and fixtures, and adjacent land use.

G. A collision diagram showing crash experience by type, location, direction of movement, severity, weather, time of day, date, and day of week for at least 1 year.

18 The following data, which are desirable for a more precise understanding of the operation of the intersection, may be obtained during the periods described in Item B of Paragraph 17:

A. Vehicle-hours of stopped time delay determined separately for each approach.

B. The number and distribution of acceptable gaps in vehicular traffic on the major street for entrance from the minor street.

C. The posted or statutory speed limit or the 85th-percentile speed on controlled approaches at a point near to the intersection but unaffected by the control.

D. Pedestrian delay time for at least two 30-minute peak pedestrian delay periods of an average weekday or like periods of a Saturday or Sunday.

E. Queue length on stop-controlled approaches.

Standard:

19 **Delay, congestion, approach conditions, driver confusion, future land use or other evidence of the need for right of way assignment beyond that which could be provided by stop sign shall be demonstrated.**

Support:

20 Figure 4C–101(CA) and 4C-103(CA) are examples of warrant sheets.

Guidance:

21 *Figure 4C-103(CA) should be used only for new intersections or other locations where it is not reasonable to count actual traffic volumes.*

Section 4C.02 Warrant 1, Eight-Hour Vehicular Volume

Support:

01 The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

02 The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

03 It is intended that Warrant 1 be treated as a single warrant. If Condition A is satisfied, then Warrant 1 is satisfied and analyses of Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then Warrant 1 is satisfied and an analysis of the combination of Conditions A and B is not needed.

Standard:

04 **The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:**

A. The vehicles per hour given in both of the 100 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or

B. The vehicles per hour given in both of the 100 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

In applying each condition the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

Option:

05 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 70 percent columns in Table 4C-1 may be used in place of the 100 percent columns.

Guidance:

06 *The combination of Conditions A and B is intended for application at locations where Condition A is not satisfied and Condition B is not satisfied and should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.*

Standard:

07 **The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exist for each of any 8 hours of an average day:**

A. The vehicles per hour given in both of the 80 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; and

B. The vehicles per hour given in both of the 80 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

These major-street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Option:

08 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.03 Warrant 2, Four-Hour Vehicular Volume

Support:

01 The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

Section 4C.04 Warrant 3, Peak Hour

Support:

01 The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:

02 **This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.**

03 **The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:**

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and

3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Option:

04 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to evaluate the criteria in the second category of the Standard.

05 If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal may be operated in the flashing mode during the hours that the volume criteria of this warrant are not met.

Guidance:

06 *If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal should be traffic-actuated.*

Section 4C.05 Warrant 4, Pedestrian Volume

Support:

01 The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard:

02 **The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:**

A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or

B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 35 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-6 may be used in place of Figure 4C-5 to evaluate Criterion A in Paragraph 2, and Figure 4C-8 may be used in place of Figure 4C-7 to evaluate Criterion B in Paragraph 2.

Standard:

04 **The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal or STOP sign controlling the street that pedestrians desire to cross is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

05 **If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E.**

Guidance:

06 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.

B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site

accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.

C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.

Option:

07 The criterion for the pedestrian volume crossing the major street may be reduced as much as 50 percent if the 15th-percentile crossing speed of pedestrians is less than 3.5 feet per second.

08 A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street.

Section 4C.06 Warrant 5, School Crossing

Support:

01 The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word "schoolchildren" includes elementary through high school students.

Standard:

02 **The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour.**

03 **Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.**

04 **The School Crossing signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

Guidance:

05 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.

B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.

C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.

Section 4C.07 Warrant 6, Coordinated Signal System

Support:

01 Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that one of the following criteria is met:**

A. On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.

B. On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

Guidance:

03 *The Coordinated Signal System signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 1,000 feet.*

Section 4C.08 Warrant 7, Crash Experience

Support:

01 The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:**

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.09 Warrant 8, Roadway Network

Support:

01 Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:**

A. The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or

B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday).

03 **A major route as used in this signal warrant shall have at least one of the following characteristics:**

A. It is part of the street or highway system that serves as the principal roadway network for through traffic flow.

B. It includes rural or suburban highways outside, entering, or traversing a city.

C. It appears as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study.

Section 4C.10 Warrant 9, Intersection Near a Grade Crossing

Support:

01 The Intersection Near a Grade Crossing signal warrant is intended for use at a location where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a

grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

Guidance:

02 *This signal warrant should be applied only after adequate consideration has been given to other alternatives or after a trial of an alternative has failed to alleviate the safety concerns associated with the grade crossing. Among the alternatives that should be considered or tried are:*

A. Providing additional pavement that would enable vehicles to clear the track or that would provide space for an evasive maneuver, or

B. Reassigning the stop controls at the intersection to make the approach across the track a non-stopping approach.

Standard:

03 **The need for a traffic control signal shall be considered if an engineering study finds that both of the following criteria are met:**

A. A grade crossing exists on an approach controlled by a STOP or YIELD sign and the center of the track nearest to the intersection is within 140 feet of the stop line or yield line on the approach; and

B. During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the minor-street approach that crosses the track (one direction only, approaching the intersection) falls above the applicable curve in Figure 4C-9 or 4C-10 for the existing combination of approach lanes over the track and the distance D, which is the clear storage distance as defined in Section 1A.13.

Guidance:

04 *The following considerations apply when plotting the traffic volume data on Figure 4C-9 or 4C-10:*

A. Figure 4C-9 should be used if there is only one lane approaching the intersection at the track crossing location and Figure 4C-10 should be used if there are two or more lanes approaching the intersection at the track crossing location.

B. After determining the actual distance D, the curve for the distance D that is nearest to the actual distance D should be used. For example, if the actual distance D is 95 feet, the plotted point should be compared to the curve for D = 90 feet.

C. If the rail traffic arrival times are unknown, the highest traffic volume hour of the day should be used.

Option:

05 The minor-street approach volume may be multiplied by up to three adjustment factors as provided in Paragraphs 6 through 8.

06 Because the curves are based on an average of four occurrences of rail traffic per day, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-2 for the appropriate number of occurrences of rail traffic per day.

07 Because the curves are based on typical vehicle occupancy, if at least 2% of the vehicles crossing the track are buses carrying at least 20 people, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-3 for the appropriate percentage of high-occupancy buses.

08 Because the curves are based on tractor-trailer trucks comprising 10% of the vehicles crossing the track, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-4 for the appropriate distance and percentage of tractor-trailer trucks.

Standard:

09 **If this warrant is met and a traffic control signal at the intersection is justified by an engineering study, then:**

A. The traffic control signal shall have actuation on the minor street;

B. Preemption control shall be provided in accordance with Sections 4D.27, 8C.09, and 8C.10; and

C. The grade crossing shall have flashing-light signals (see Chapter 8C).

Guidance:

10 *If this warrant is met and a traffic control signal at the intersection is justified by an engineering study, the grade crossing should have automatic gates (see Chapter 8C).*

Section 4C.101(CA) Criterion for School Crossing Traffic Signals

01 **Standard:**

A. The signal shall be designed for full-time operation.

B. Pedestrian signal faces of the International Symbol type shall be installed at all marked crosswalks at signalized intersections along the "Suggested Route to School."

C. If an intersection is signalized under this guideline for school pedestrians, the entire intersection shall be signalized.

D. School area traffic signals shall be traffic actuated type with push buttons or other detectors for pedestrians.

Option:

02 Non-intersection school pedestrian crosswalk locations may be signalized when justified.

Section 4C.102(CA) Bicycle Signal Warrant

Guidance:

01 *A bicycle signal should be considered for use only when the volume and collision or volume and geometric warrants have been met:*

1. *Volume; When W = B x V and W ≥ 50,000 and B ≥ 50.*
   Where: W is the volume warrant. B is the number of bicycles at the peak hour entering the intersection. V is the number of vehicles at the peak hour entering the intersection. B and V shall use the same peak hour.
2. *Collision; When 2 or more bicycle/vehicle collisions of types susceptible to correction by a bicycle signal have occurred over a 12-month period and the responsible public works official determines that a bicycle signal will reduce the number of collisions.*
3. *Geometric;*
   (a) Where a separate bicycle/ multi use path intersects a roadway.
   (b) At other locations to facilitate a bicycle movement that is not permitted for a motor vehicle.

APPENDIX B

AVERAGE DAILY TRAFFIC (ADT) COUNT DATA

&

PEAK-HOUR TURNING MOVEMENT COUNT DATA

Prepared by National Data & Surveying Services

VOLUME

Eastern Ave & Jillson St

Day: Wednesday
Date: 08/23/2023

HIGHEST 8 HOURS PER SIDE-STREET PERSPECTIVE.

City: Commerce
Project #: CA23_020305_001

DAILY TOTALS	NB	SB	EB	WB	Total
	5,331	7,499	916	958	14,704

AM Period	NB		SB		EB		WB		TOTAL		PM Period	NB		SB		EB		WB		TOTAL	
0:00	13		20		1		0		34		12:00	103		110		27		17		257	
0:15	12		11		0		0		23		12:15	77		98		22		17		214	
0:30	14		13		1		0		28		12:30	78		114		16		19		227	
0:45	9	48	11	55	1	3	2	2	23	108	12:45	91	349	119	441	21	86	21	74	252	950
1:00	10		12		1		2		25		13:00	96		131		15		36		278	
1:15	9		11		1		1		22		13:15	98		127		18		19		262	
1:30	9		6		0		1		16		13:30	85		108		18		18		229	
1:45	10	38	10	39	0	2	1	5	21	84	13:45	84	363	108	474	12	63	12	85	216	985
2:00	10		9		1		1		21		14:00	88		109		21		20		238	
2:15	10		15		1		0		26		14:15	84		127		10		10		231	
2:30	7		16		0		0		23		14:30	101		117		12		26		256	
2:45	9	36	18	58	2	4	0	1	29	99	14:45	110	383	117	470	14	57	9	65	250	975
3:00	7		15		0		2		24		15:00	92		124		16		12		244	
3:15	7		19		1		0		27		15:15	78		147		25		17		267	
3:30	12		23		2		3		40		15:30	115		134		18		14		281	
3:45	10	36	27	84	3	6	1	6	41	132	15:45	108	393	150	555	22	81	18	61	298	1090
4:00	12		19		1		0		32		16:00	120		142		18		11		291	
4:15	12		18		0		1		31		16:15	90		145		11		8		254	
4:30	18		30		0		4		52		16:30	140		138		20		16		314	
4:45	20	62	41	108	5	6	4	9	70	185	16:45	118	468	139	564	12	61	17	52	286	1145
5:00	19		28		2		1		50		17:00	134		138		20		30		322	
5:15	26		35		0		4		65		17:15	105		156		11		11		283	
5:30	25		36		6		3		70		17:30	137		131		13		14		295	
5:45	48	118	62	161	3	11	9	17	122	307	17:45	79	455	164	589	17	61	14	69	274	1174
6:00	34		53		6		8		101		18:00	63		121		12		15		211	
6:15	42		60		9		10		121		18:15	78		151		10		15		254	
6:30	43		76		8		9		136		18:30	60		134		13		10		217	
6:45	60	179	106	295	11	34	17	44	194	552	18:45	53	254	115	521	7	42	9	49	184	866
7:00	69		99		18		12		198		19:00	41		93		11		13		158	
7:15	75		101		19		14		209		19:15	51		77		5		9		142	
7:30	82		121		13		22		238		19:30	48		68		4		5		125	
7:45	103	329	174	495	30	80	37	85	344	989	19:45	43	183	44	282	9	29	7	34	103	528
8:00	75		128		18		25		246		20:00	49		47		6		6		108	
8:15	89		109		19		10		227		20:15	39		39		6		9		93	
8:30	76		164		19		17		276		20:30	49		59		4		10		122	
8:45	66	306	134	535	21	77	14	66	235	984	20:45	35	172	53	198	5	21	9	34	102	425
9:00	64		109		7		14		194		21:00	58		38		6		13		115	
9:15	83		97		14		7		201		21:15	56		27		2		7		92	
9:30	58		89		7		15		169		21:30	54		42		1		4		101	
9:45	61	266	112	407	7	35	14	50	194	758	21:45	20	188	48	155	7	16	1	25	76	384
10:00	58		99		10		11		178		22:00	16		28		1		5		50	
10:15	69		86		20		13		188		22:15	26		31		1		1		59	
10:30	63		94		13		15		185		22:30	27		35		1		3		66	
10:45	60	250	96	375	17	60	14	53	187	738	22:45	28	97	34	128	2	5	0	9	64	239
11:00	62		110		12		11		195		23:00	30		25		0		3		58	
11:15	58		88		16		15		177		23:15	18		21		2		1		42	
11:30	82		131		19		8		240		23:30	13		14		4		1		32	
11:45	82	284	103	432	22	69	23	57	230	842	23:45	13	74	18	78	1	7	1	6	33	165
TOTALS		1952		3044		387		395		**5778**	**TOTALS**		3379		4455		529		563		**8926**
SPLIT %		33.8%		52.7%		6.7%		6.8%		**39.3%**	**SPLIT %**		37.9%		49.9%		5.9%		6.3%		**60.7%**

DAILY TOTALS	NB	SB	EB	WB	Total
	5,331	7,499	916	958	14,704

AM Peak Hour	7:30	7:45	11:30	7:15	**7:45**	**PM Peak Hour**	16:30	17:00	12:00	12:30	**16:30**
AM Pk Volume	349	575	90	98	**1093**	**PM Pk Volume**	497	589	86	95	**1205**
Pk Hr Factor	0.847	0.826	0.833	0.662	**0.794**	**Pk Hr Factor**	0.888	0.898	0.796	0.660	**0.936**
7 - 9 Volume	635	1030	157	151	**1973**	**4 - 6 Volume**	923	1153	122	121	**2319**
7 - 9 Peak Hour	7:30	7:45	7:45	7:15	**7:45**	**4 - 6 Peak Hour**	16:30	17:00	16:15	16:30	**16:30**
7 - 9 Pk Volume	349	575	86	98	**1093**	**4 - 6 Pk Volume**	497	589	63	74	**1205**
Pk Hr Factor	0.847	0.826	0.717	0.662	**0.794**	**Pk Hr Factor**	0.888	0.898	0.788	0.617	**0.936**

Prepared by National Data & Surveying Services

Eastern Ave & Jillson St

Peak Hour Turning Movement Count

ID: 23-020305-001
City: Commerce

Day: Wednesday
Date: 08/23/2023

PEAK HOURS	COUNT PERIODS
07:45 am - 08:45 am	7:00 AM - 09:00 AM
NONE	NONE
04:30 pm - 05:30 pm	4:00 PM - 06:00 PM

SOUTHBOUND (Eastern Ave)

AM	24	443	101	1	342	AM
NOON	0	0	0	0	0	NOON
PM	14	531	27	1	528	PM

EASTBOUND (Jillson St)

AM	NOON	PM	
87	0	47	
0	0	0	0
11	0	15	0
38	0	25	1
38	0	22	0

WESTBOUND (Jillson St)

	PM	NOON	AM
0	56	0	55
1	14	0	27
0	5	0	8
0	0	0	0
	72	0	171

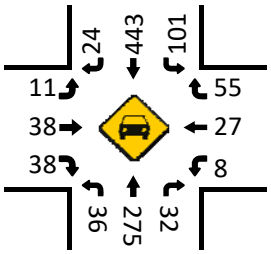
NORTHBOUND (Eastern Ave)

PM	558	0	19	456	20	PM
NOON	0	0	0	0	0	NOON
AM	491	2	36	275	32	AM

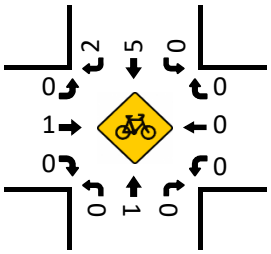
CONTROL: 2-Way Stop(EB/WB)

	AM	NOON	PM
TEV	1091	0	1205
PHF	0.80		0.93

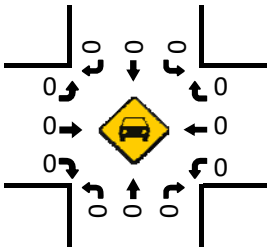
Totals (AM)



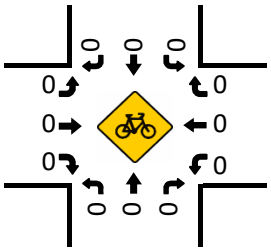
Total Bikes (AM)



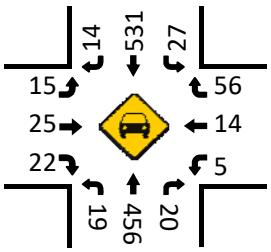
Totals (NOON)



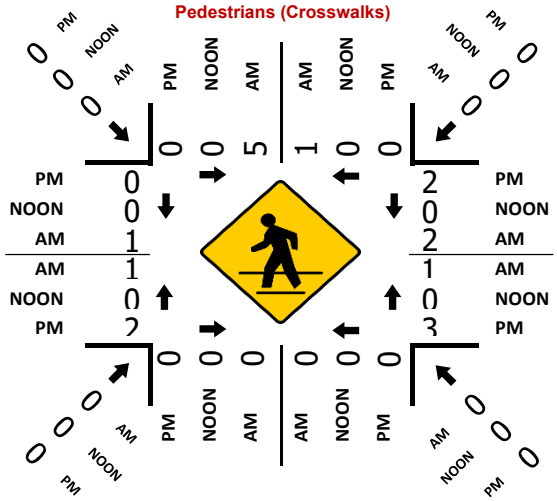
Total Bikes (NOON)



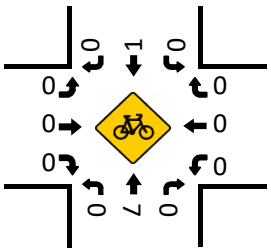
Totals (PM)



Pedestrians (Crosswalks)



Total Bikes (PM)



National Data & Surveying Services

Intersection Turning Movement Count

Location: Eastern Ave & Jillson St
City: Commerce
Control: 2-Way Stop(EB/WB)

Project ID: 23-020305-001
Date: 08/23/2023

Data - Totals

NS/EW Streets:	Eastern Ave				Eastern Ave				Jillson St				Jillson St				
AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	1	1	1	0	1	1	1	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
7:00 AM	7	62	1	0	8	87	5	0	0	9	9	0	1	4	7	0	200
7:15 AM	12	59	4	0	9	83	6	0	0	10	8	0	0	2	12	0	205
7:30 AM	10	63	9	0	23	97	3	0	1	5	7	0	0	4	18	0	240
7:45 AM	17	78	8	1	38	129	5	0	2	17	11	0	2	13	22	0	343
8:00 AM	6	57	12	0	29	90	6	1	4	7	7	0	0	7	18	0	244
8:15 AM	6	79	4	1	14	92	4	0	2	6	11	0	0	3	7	0	229
8:30 AM	7	61	8	0	20	132	9	0	3	8	9	0	6	4	8	0	275
8:45 AM	7	51	8	0	15	115	3	0	2	11	9	1	2	5	6	0	235
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	72	510	54	2	156	825	41	1	14	73	71	1	11	42	98	0	1971
APPROACH %'s :	11.29%	79.94%	8.46%	0.31%	15.25%	80.65%	4.01%	0.10%	8.81%	45.91%	44.65%	0.63%	7.28%	27.81%	64.90%	0.00%	
PEAK HR :	07:45 am - 08:45 am																TOTAL
PEAK HR VOL :	36	275	32	2	101	443	24	1	11	38	38	0	8	27	55	0	1091
PEAK HR FACTOR :	0.529	0.870	0.667	0.500	0.664	0.839	0.667	0.250	0.688	0.559	0.864	0.000	0.333	0.519	0.625	0.000	0.795
	0.829				0.827				0.725				0.608				

PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	1	1	1	0	1	1	1	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
4:00 PM	2	107	10	1	19	119	2	0	3	9	8	0	1	1	9	0	291
4:15 PM	9	77	3	1	9	132	3	0	1	3	5	0	0	0	8	0	251
4:30 PM	5	124	9	0	4	131	6	1	7	2	10	0	4	2	10	0	315
4:45 PM	6	108	4	0	2	133	2	0	1	8	3	0	0	3	14	0	284
5:00 PM	5	125	4	0	10	127	3	0	5	9	7	0	1	6	23	0	325
5:15 PM	3	99	3	0	11	140	3	0	2	6	2	0	0	3	9	0	281
5:30 PM	4	127	5	0	5	125	2	0	2	6	5	0	1	1	12	0	295
5:45 PM	2	72	6	0	9	151	2	0	3	4	10	1	0	2	11	0	273
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	36	839	44	2	69	1058	23	1	24	47	50	1	7	18	96	0	2315
APPROACH %'s :	3.91%	91.10%	4.78%	0.22%	5.99%	91.92%	2.00%	0.09%	19.67%	38.52%	40.98%	0.82%	5.79%	14.88%	79.34%	0.00%	
PEAK HR :	04:30 pm - 05:30 pm																TOTAL
PEAK HR VOL :	19	456	20	0	27	531	14	1	15	25	22	0	5	14	56	0	1205
PEAK HR FACTOR :	0.792	0.912	0.556	0.000	0.614	0.948	0.583	0.250	0.536	0.694	0.550	0.000	0.313	0.583	0.609	0.000	0.927
	0.897				0.930				0.738				0.625				

National Data & Surveying Services

Intersection Turning Movement Count

Location: Eastern Ave & Jillson St
City: Commerce

Project ID: 23-020305-001
Date: 08/23/2023

Data - Pedestrians (Crosswalks)

NS/EW Streets:	Eastern Ave		Eastern Ave		Jillson St		Jillson St		
AM	NORTH LEG		SOUTH LEG		EAST LEG		WEST LEG		
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
7:00 AM	1	0	0	0	0	0	1	0	2
7:15 AM	0	0	0	0	1	0	1	0	2
7:30 AM	0	0	0	0	1	0	0	0	1
7:45 AM	2	0	0	0	0	0	0	0	2
8:00 AM	1	1	0	0	1	2	0	1	6
8:15 AM	1	0	0	0	0	0	1	0	2
8:30 AM	1	0	0	0	0	0	0	0	1
8:45 AM	0	0	0	0	0	0	0	0	0
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
TOTAL VOLUMES :	6	1	0	0	3	2	3	1	16
APPROACH %'s :	85.71%	14.29%			60.00%	40.00%	75.00%	25.00%	
PEAK HR :	**07:45 am - 08:45 am**								TOTAL
PEAK HR VOL :	5	1	0	0	1	2	1	1	11
PEAK HR FACTOR :	0.625	0.250			0.250	0.250	0.250	0.250	0.458
	0.750				0.250		0.500		

PM	NORTH LEG		SOUTH LEG		EAST LEG		WEST LEG		
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
4:00 PM	0	1	0	0	0	0	0	0	1
4:15 PM	0	0	0	0	0	0	0	1	1
4:30 PM	0	0	0	0	0	2	1	0	3
4:45 PM	0	0	0	0	2	0	0	0	2
5:00 PM	0	0	0	0	1	0	0	0	1
5:15 PM	0	0	0	0	0	0	1	0	1
5:30 PM	0	0	0	0	1	0	1	0	2
5:45 PM	0	0	0	0	0	0	0	1	1
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
TOTAL VOLUMES :	0	1	0	0	4	2	3	2	12
APPROACH %'s :	0.00%	100.00%			66.67%	33.33%	60.00%	40.00%	
PEAK HR :	**04:30 pm - 05:30 pm**								TOTAL
PEAK HR VOL :	0	0	0	0	3	2	2	0	7
PEAK HR FACTOR :					0.375	0.250	0.500		0.583
					0.625		0.500		

National Data & Surveying Services

Intersection Turning Movement Count

Location: Eastern Ave & Jillson St
City: Commerce
Control: 2-Way Stop(EB/WB)

Project ID: 23-020305-001
Date: 08/23/2023

Data - Bikes

NS/EW Streets:	Eastern Ave				Eastern Ave				Jillson St				Jillson St				
AM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	1	1	1	0	1	1	1	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
7:00 AM	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
7:15 AM	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
7:30 AM	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
7:45 AM	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
8:00 AM	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	4
8:15 AM	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
8:30 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
8:45 AM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	1	3	0	0	0	9	2	0	0	1	0	0	0	0	0	0	16
APPROACH %'s :	25.00%	75.00%	0.00%	0.00%	0.00%	81.82%	18.18%	0.00%	0.00%	100.00%	0.00%	0.00%					
PEAK HR :	07:45 am - 08:45 am																TOTAL
PEAK HR VOL :	0	1	0	0	0	5	2	0	0	1	0	0	0	0	0	0	9
PEAK HR FACTOR :	0.000	0.250	0.000	0.000	0.000	0.417	0.500	0.000	0.000	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.563
		0.250				0.583				0.250							

PM	NORTHBOUND				SOUTHBOUND				EASTBOUND				WESTBOUND				
	1	1	1	0	1	1	1	0	0	1	0	0	0	1	0	0	
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4:45 PM	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
5:00 PM	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3
5:45 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL
TOTAL VOLUMES :	0	9	0	0	0	1	0	0	2	0	0	0	0	0	0	0	12
APPROACH %'s :	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%					
PEAK HR :	04:30 pm - 05:30 pm																TOTAL
PEAK HR VOL :	0	7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	8
PEAK HR FACTOR :	0.000	0.438	0.000	0.000	0.000	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500
		0.438				0.250											

APPENDIX C

INTERSECTION COLLISION HISTORY

CITY OF COMMERCE
5-YEAR SWITRS COLLISION DATABASE
INTERSECTION OF EASTERN AVENUE AT JILLSON STREET
JAN. 1, 2018 - SEP. 31, 2023

CASE ID	COLL. DATE	COLL. TIME	PRIMARY ROAD	SECONDARY ROAD	DIST.	DIR.	INTERS.	WEATH. 1	COLL. SEVERITY	PRIM. COLL. FACT.	PCF VIOL CAT.	PCF VIOL.	HIT AND RUN	TYPE OF COLL.	MOTOR VEHICLE INVOLVED WITH	ROAD SURF.
8608851	20180223	1806	EASTERN AV	JILLSON ST	0		Y	A	0	D	0		N	D	C	C
8603464	20180301	1830	EASTERN AV	JILLSON ST	50	S	N	A	0	A	8	22107	M	B	C	A
8690279	20180329	2114	EASTERN AV	JILLSON ST	12	S	N	A	0	A	9	21800	N	D	C	A
8676940	20180523	1841	EASTERN AV	JILLSON ST	17	S	N	A	0	A	9	21801	N	D	C	A
8650126	20180723	950	EASTERN AV	JILLSON ST	0		Y	A	0	A	9	21802	N	D	C	A
8705711	20180729	1106	EASTERN AV	JILLSON ST	25	N	N	A	0	A	3	22350	N	-	C	A
8746059	20180918	1300	EASTERN AV	JILLSON ST	0		Y	A	0	A	9	21801	N	D	C	A
8770759	20181116	715	EASTERN AV	JILLSON ST	0		Y	A	0	A	0	21302	N	D	C	A
8946440	20190328	918	JILLSON ST	EASTERN AV	0	E	N	A	0	A	8	22107	N	B	E	A
8927267	20190611	726	EASTERN AV	JILLSON ST	0		Y	A	0	A	9	21804	N	D	C	A
8927482	20190724	1653	JILLSON ST	EASTERN AV	19	W	N	A	4	A	6	21755	N	D	C	A
8957083	20190807	1200	EASTERN AV	JILLSON ST	0		Y	A	0	A	-		N	D	C	A
9052671	20190923	1530	EASTERN AV	JILLSON ST	40	N	N	A	4	A	3	22350	N	C	C	A
9074291	20200305	1517	EASTERN AV	JILLSON ST	0		Y	A	4	A	9	21801	N	D	C	A
9140113	20200622	1458	EASTERN AV	JILLSON ST	0		Y	A	0	A	9	21804	N	D	C	-
9236393	20200921	2130	EASTERN AV	JILLSON ST	0		Y	A	2	A	12	22450	N	-	C	A
9401198	20211109	1627	EASTERN AV	JILLSON ST	15	N	N	A	0	D	0		N	D	C	A
9400544	20211130	1900	EASTERN AV	JILLSON ST	0		Y	A	0	A	8	22107	N	E	I	A
9477332	20220501	211	EASTERN AV	JILLSON ST	40	N	N	A	0	-	-		N	A	-	A
9553268	20230110	846	EASTERN AV	JILLSON ST	0		N	B	0	A	8	22107	N	B	C	B
9564443	20230307	1624	EASTERN AV	JILLSON ST	0		Y	C	0	A	3	22350	M	B	D	B
9564476	20230322	1100	EASTERN AV	JILSON ST	0		Y	C	0	A	3	22350	M	D	C	B
9603239	20230421	930	EASTERN AV	JILLSON ST	0		Y	A	0	A	21	22106	N	D	C	A
9602863	20230629	1835	EASTERN AV	JILLSON ST	0		Y	A	3	A	8	22107	N	D	C	A
9597327	20230630	1713	EASTERN AV	JILLSON ST	0		Y	A	0	A	8	22107	N	D	C	A

CITY OF COMMERCE
5-YEAR SWITRS COLLISION DATABASE
INTERSECTION OF EASTERN AVENUE AT JILLSON STREET
JAN. 1, 2018 - SEP. 31, 2023

CASE ID	COLL. DATE	COLL. TIME	PRIMARY ROAD	SECONDARY ROAD	DIST.	DIR.	INTERS.	WEATH. 1	COLL. SEVERITY	PRIM. COLL. FACT.	PCF VIOL CAT.	PCF VIOL.	HIT AND RUN	TYPE OF COLL.	MOTOR VEHICLE INVOLVED WITH	ROAD SURF.

NOTES:

Weather 1
A - Clear
B - Cloudy
C - Raining
D - Snowing
E - Fog
F - Other
G - Wind
- - Not Stated

Collision Severity
1 - Fatal
2 - Injury (Severe)
3 - Injury (Other Visible)
4 - Injury (Complaint of Pain)
0 - PDO (Property Damage Only)

Primary Collision Factor
A - (Vehicle) Code Violation
B - Other Improper Driving
C - Other Than Driver
D - Unknown
E - Fell Asleep
- - Not Stated

Motor Vehicle Involved With:
A - Non-Collision
B - Pedestrian
C - Other Motor Vehicle
D - Motor Vehicle on Other Roadway
E - Parked Motor Vehicle
F - Train
G - Bicycle
H - Animal
I - Fixed Object
J - Other Object
- - Not Stated

PCF Violation Category
01 - Driving or Bicycling Under Influence
02 - Impeding Traffic
03 - Unsafe Speed
04 - Following Too Closely
05 - Wrong Side of Road
06 - Improper Passing
07 - Unsafe Lane Change
08 - Improper Turning
09 - Automobile ROW
10 - Pedestrian ROW
11 - Pedestrian Violation
12 - Traffic Signals and Signs
13 - Hazardous Parking
14 - Lights
15 - Brakes
16 - Other Equipment
17 - Other Hazardous Violation
18 - Other Than Driver (or Ped)
19 -
20 -
21 - Unsafe Starting or Backing
22 - Other Improper Driving
23 - Pedestrian or "Other" Under the Influence
24 - Fell Asleep
00 - Unknown
- - Not Stated

Hit and Run
F - Felony
M - Misdemeanor
N - Not Hit & Run

Road Surface
A - Dry
B - Wet
C - Snowy or Icy
D - Slippery
- - Not Stated

Type of Collision
A - Head-On
B - Sideswipe
C - Rear-End
D - Broadside
E - Hit Object
F - Overturned
G - Vehicle/Pedestrian
H - Other
- - Not Stated

APPENDIX D

CALIFORNIA MUTCD

STOPPING SIGHT DISTANCE AS A FUNCTION OF SPEED:

Table 6C-1. Recommended Advance Warning Sign ~~Minimum~~ Spacing

Road Type	Distance Between Signs**		
	A	B	C
Urban ~~(low speed)~~ - 25 mph or less***	100 feet	100 feet	100 feet
Urban - more than 25 mph to 40 mph***	250 feet	250 feet	250 feet
Urban ~~(high speed)~~ - more than 40 mph***	350 feet	350 feet	350 feet
Rural	500 feet	500 feet	500 feet
Expressway / Freeway	1,000 feet	1,500 feet	2,640 feet

* ~~Speed category to be determined by the highway agency.~~

** The column headings A, B, and C are the dimensions shown in Figures 6H-1 through 6H-46. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The "first sign" is the sign in a three-sign series that is closest to the TTC zone. The "third sign" is the sign that is furthest upstream from the TTC zone.)

*** Posted speed limit, off-peak 85th-percentile speed prior to work starting, or other anticipated operating speed in mph.

Table 6C-2. Stopping Sight Distance as a Function of Speed on Level Roads. (Used as suggested longitudinal buffer space length or location for flagger station)

Speed*	Distance
20 mph	115 feet
25 mph	155 feet
30 mph	200 feet
35 mph	250 feet
40 mph	305 feet
45 mph	360 feet
50 mph	425 feet
55 mph	495 feet
60 mph	570 feet
65 mph	645 feet
70 mph	730 feet
75 mph	820 feet

* Posted speed, off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in mph.

Table 6C-3. Taper Length Criteria for Temporary Traffic Control Zones

Type of Taper	Taper Length
Merging Taper	at least L
Shifting Taper	at least 0.5 L
Shoulder Taper	at least 0.33 L
One-Lane, Two-Way Traffic Taper	50 feet minimum, 100 feet maximum
Downstream Taper	50 feet minimum, 100 feet maximum

Note: Use Table 6C-4 to calculate L

APPENDIX E

COMPLETED
CALIFORNIA MUTCD
TRAFFIC SIGNAL WARRANTS WORKSHEETS

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 1 of 5)

COUNT DATE August 23, 2023 (Wednesday)

DIST	CO	RTE	PM
	LA		

CALC _____ DATE _____
CHK _____ DATE _____

Major St: Eastern Avenue
Minor St: Jillson Street

Critical Approach Speed > Posted 40 mph
Critical Approach Speed _____ mph

Speed limit or critical speed on major street traffic > 40 mph ☑
or
In built up area of isolated community of < 10,000 population ☐
→ RURAL (R)
☐ URBAN (U)

WARRANT 1 - Eight Hour Vehicular Volume SATISFIED YES ☑ NO ☐
(Condition A or Condition B or combination of A and B must be satisfied)

Condition A - Minimum Vehicle Volume 100% SATISFIED YES ☐ NO ☑
80% SATISFIED YES ☐ NO ☑

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)				7AM	8AM	11AM	12PM	1PM	2PM	3PM	5PM
	U	R	U	R								Hour
APPROACH LANES	1		2 or More									
Both Approaches Major Street	500 (400)	350 (280)	600 (480)	420 (336)	824	841	716	790	837	853	948	1044
Highest Approach Minor Street	150 (120)	105 (84)	200 (160)	140 (112)	85	77	69	86	85	65	81	69

Condition B - Interruption of Continuous Traffic 100% SATISFIED YES ☑ NO ☐
80% SATISFIED YES ☑ NO ☐

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)				7AM	8AM	11AM	12PM	1PM	2PM	3PM	5PM
	U	R	U	R								Hour
APPROACH LANES	1		2 or More									
Both Approaches Major Street	750 (600)	525 (420)	900 (720)	630 (504)	824	841	716	790	837	853	948	1044
Highest Approach Minor Street	75 (60)	53 (42)	100 (80)	70 (56)	85	77	69	86	85	65	81	69

Combination of Conditions A & B SATISFIED YES ☐ NO ☑

REQUIREMENT	CONDITION	✓	FULFILLED
TWO CONDITIONS SATISFIED 80%	A. MINIMUM VEHICULAR VOLUME		Yes ☐ No ☑
	AND, B. INTERRUPTION OF CONTINUOUS TRAFFIC	✓	
AND, AN ADEQUATE TRIAL OF OTHER ALTERNATIVES THAT COULD CAUSE LESS DELAY AND INCONVENIENCE TO TRAFFIC HAS FAILED TO SOLVE THE TRAFFIC PROBLEMS			Yes ☐ No ☐

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 2 of 5)

WARRANT 2 - Four Hour Vehicular Volume **SATISFIED* YES ☑ NO ☐**

Record hourly vehicular volumes for any four hours of an average day.

APPROACH LANES	One	2 or More	7AM	12PM	1PM	3PM (Hour)
Both Approaches - Major Street	✓		824	790	837	948
Higher Approach - Minor Street	✓		85	86	85	81

*All plotted points fall above the applicable curve in Figure 4C-1. (URBAN AREAS)	Yes ☐ No ☐
OR, All plotted points fall above the applicable curve in Figure 4C-2. (RURAL AREAS)	Yes ☑ No ☐

WARRANT 3 - Peak Hour **SATISFIED YES ☑ NO ☐**
(Part A or Part B must be satisfied)

PART A **SATISFIED YES ☐ NO ☐**

N/A

(All parts 1, 2, and 3 below must be satisfied for the same one hour, for any four consecutive 15-minute periods)

1. The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach, or five vehicle-hours for a two-lane approach; AND	Yes ☐ No ☐
2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes; AND	Yes ☐ No ☐
3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches.	Yes ☐ No ☐

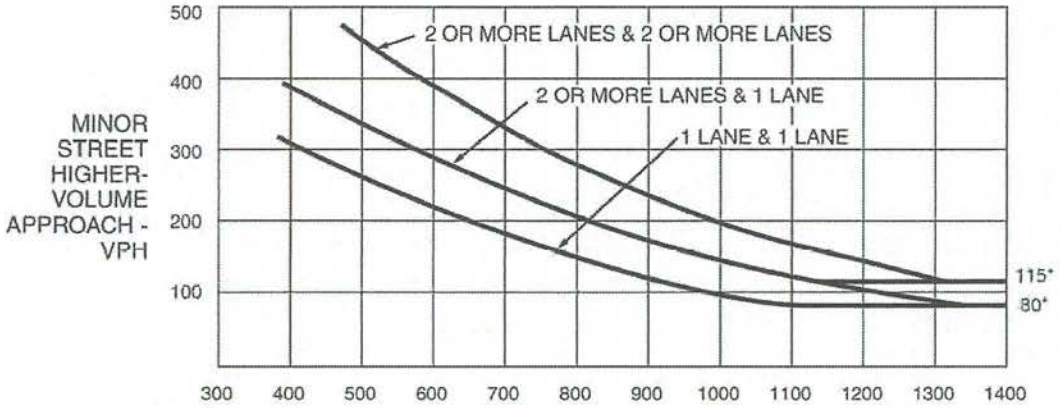
PART B **SATISFIED YES ☑ NO ☐**

APPROACH LANES	One	2 or More	3PM (Hour)
Both Approaches - Major Street	✓		948
Higher Approach - Minor Street	✓		81

The plotted point falls above the applicable curve in Figure 4C-3. (URBAN AREAS)	Yes ☐ No ☐
OR, The plotted point falls above the applicable curve in Figure 4C-4. (RURAL AREAS)	Yes ☑ No ☐

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

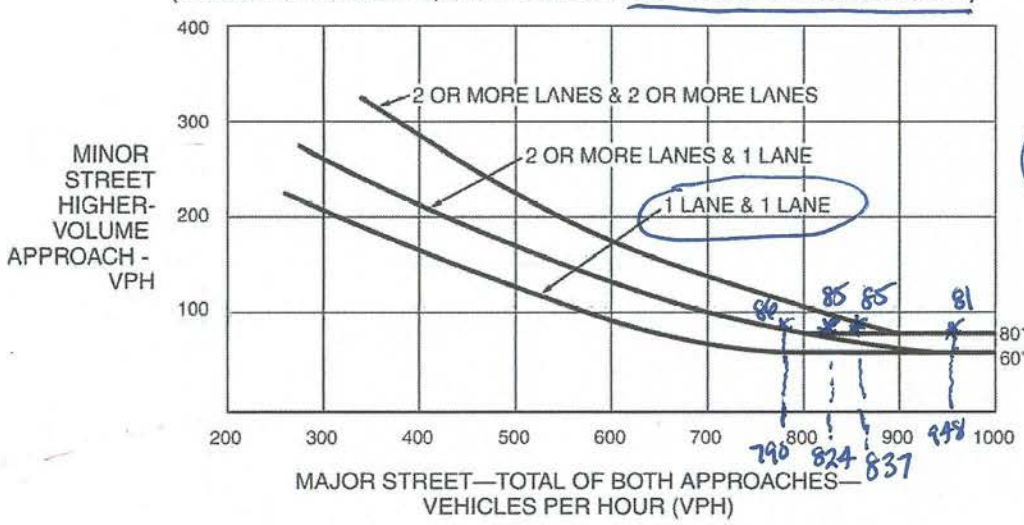
Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

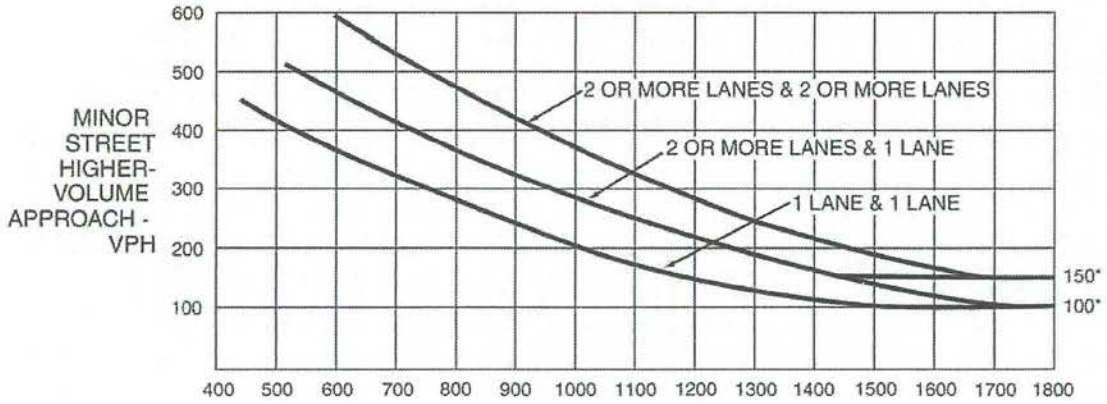
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



YES

*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

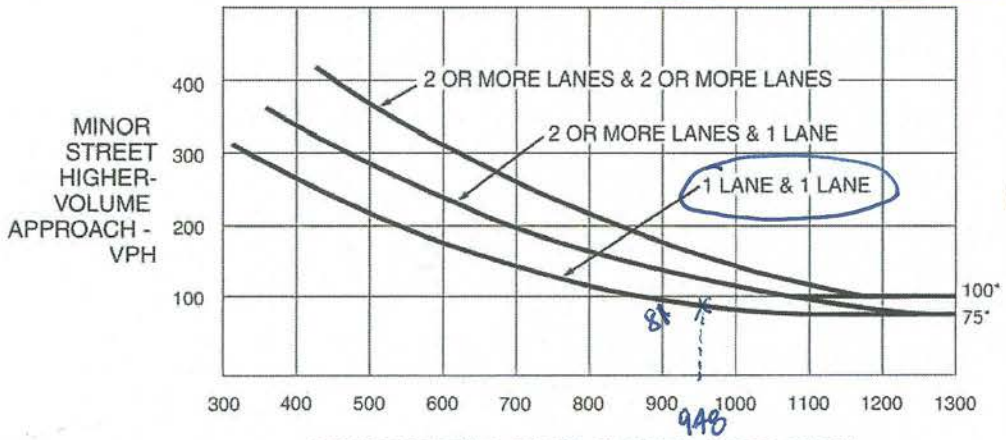
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 3 of 5)

WARRANT 4 - Pedestrian Volume
(Parts 1 and 2 Must Be Satisfied) SATISFIED YES ☐ NO ☑

Part 1 (Parts A or B must be satisfied)

	Hours - - ->	7AM	8AM	4PM	5PM
A.	Vehicles per hour for any 4 hours	824	841	1032	1044
	Pedestrians per hour for any 4 hours	3	4	1	Ø

Figure 4C-5 or Figure 4C-6 SATISFIED YES ☐ NO ☑

	Hours - - ->	7AM	8AM	4PM	5PM
B.	Vehicles per hour for any 1 hour	824	841	1032	1044
	Pedestrians per hour for any 1 hour	3	~~4~~	1	Ø

Figure 4C-7 or Figure 4C-8 SATISFIED YES ☐ NO ☑

Part 2 SATISFIED YES ☐ NO ☑

AND, The distance to the nearest traffic signal along the major street is greater than 300 ft	Yes ☐ No ☑
OR, The proposed traffic signal will not restrict progressive traffic flow along the major street.	Yes ☐ No ☐

N/A **WARRANT 5 - School Crossing**
(Parts A and B Must Be Satisfied) SATISFIED YES ☐ NO ☐

Part A SATISFIED YES ☐ NO ☐
Gap/Minutes and # of Children

		Hour
Gaps vs Minutes	Minutes Children Using Crossing	
	Number of Adequate Gaps	
School Age Pedestrians Crossing Street / hr		

Gaps < Minutes YES ☐ NO ☐
AND Children > 20/hr YES ☐ NO ☐

AND, Consideration has been given to less restrictive remedial measures.	Yes ☐ No ☐

Part B SATISFIED YES ☐ NO ☐

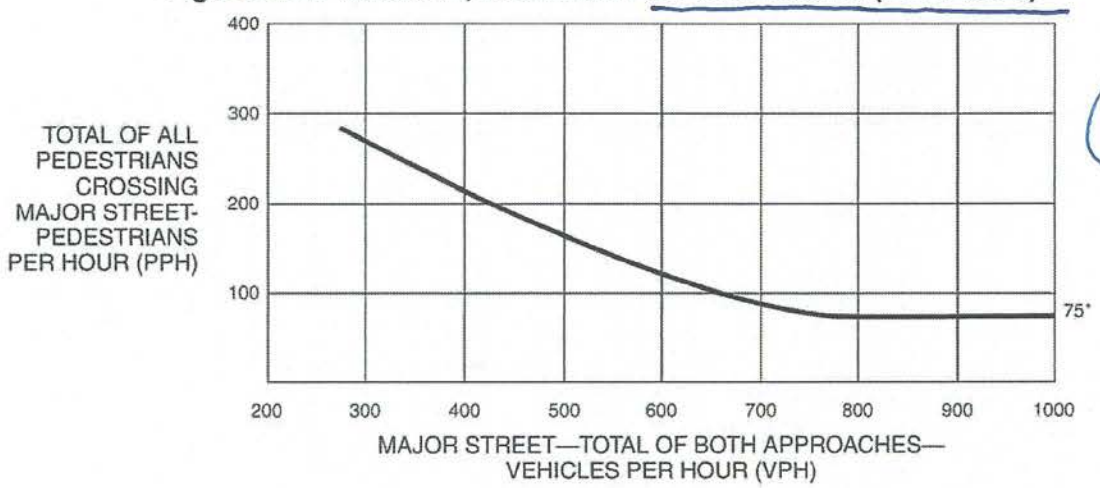
The distance to the nearest traffic signal along the major street is greater than 300 ft	Yes ☐ No ☐
OR, The proposed signal will not restrict the progressive movement of traffic.	Yes ☐ No ☐

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

*Note: 107 pph applies as the lower threshold volume.

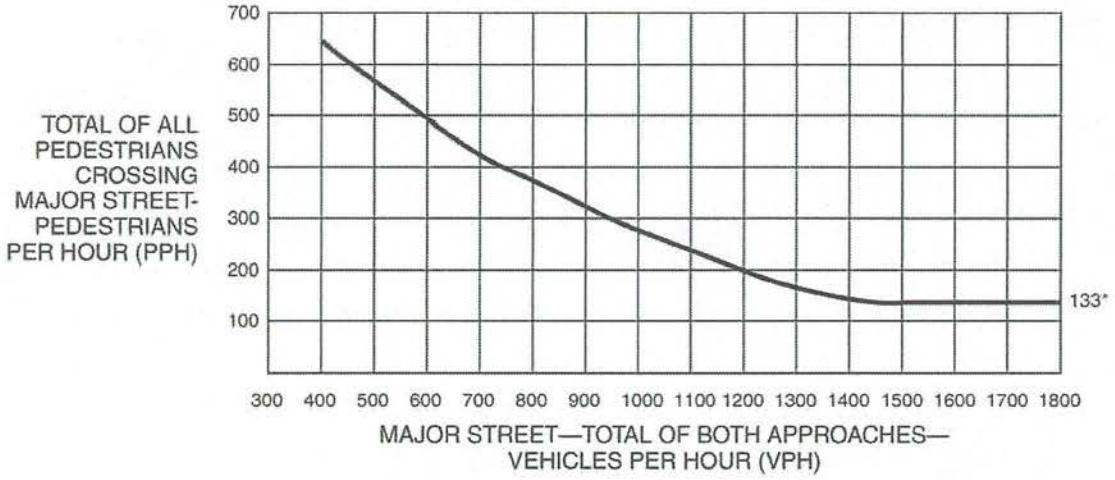
Figure 4C-6. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



NO

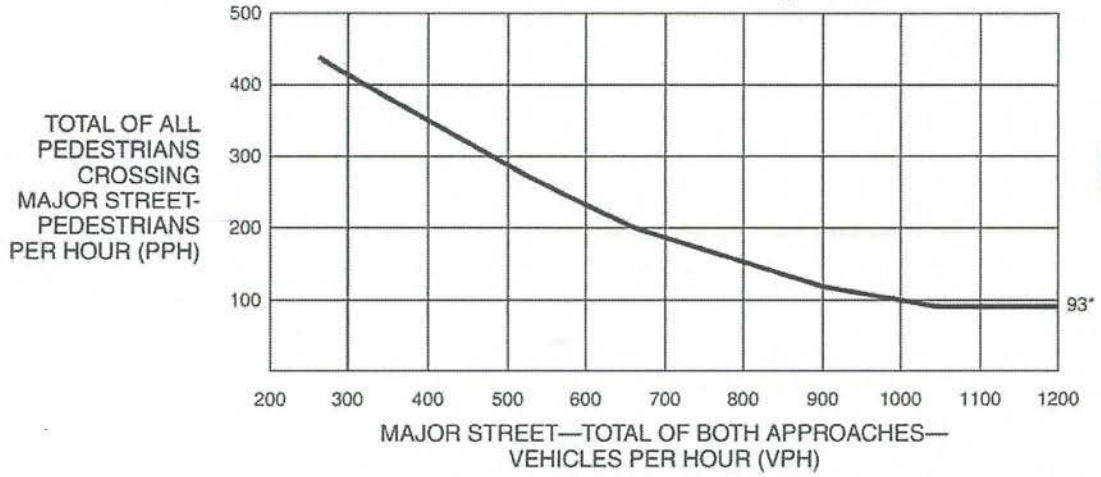
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 4 of 5)

WARRANT 6 - Coordinated Signal System **SATISFIED YES ☐ NO ☑**
(All Parts Must Be Satisfied)

MINIMUM REQUIREMENTS	DISTANCE TO NEAREST SIGNAL	
≥ 1000 ft	N 1,000 ft, S 250 ft, E N/A ft, W N/A ft	Yes ☐ No ☑
On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.		Yes ☐ No ☐
OR, On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.		

WARRANT 7 - Crash Experience Warrant **SATISFIED YES ☑ NO ☐**
(All Parts Must Be Satisfied)

Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency.			Yes ☐ No ☐
REQUIREMENTS	Number of crashes reported within a 12 month period susceptible to correction by a traffic signal, and involving injury or damage exceeding the requirements for a reportable crash.		Yes ☑ No ☐
5 OR MORE	6		
REQUIREMENTS	CONDITIONS	✓	
ONE CONDITION SATISFIED 80%	Warrant 1, Condition A - Minimum Vehicular Volume		Yes ☑ No ☐
	OR, Warrant 1, Condition B - Interruption of Continuous Traffic	✓	
	OR, Warrant 4, Pedestrian Volume Condition Ped Vol ≥ 80% of Figure 4C-5 through Figure 4C-8		

WARRANT 8 - Roadway Network **SATISFIED YES ☐ NO ☑**
(All Parts Must Be Satisfied)

MINIMUM VOLUME REQUIREMENTS	ENTERING VOLUMES - ALL APPROACHES	✓	FULFILLED
1000 Veh/Hr	During Typical Weekday Peak Hour 1,174 Veh/Hr and has 5-year projected traffic volumes that meet one or more of Warrants 1, 2, and 3 during an average weekday.	✓	Yes ☑ No ☐
	OR During Each of Any 5 Hrs. of a Sat. or Sun _____ Veh/Hr		

CHARACTERISTICS OF MAJOR ROUTES	MAJOR ROUTE A	MAJOR ROUTE B
Hwy. System Serving as Principal Network for Through Traffic	✓	—
Rural or Suburban Highway Outside Of, Entering, or Traversing a City	✓	—
Appears as Major Route on an Official Plan	✓	—
Any Major Route Characteristics Met, Both Streets		Yes ☐ No ☑

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Figure 4C-101 (CA). Traffic Signal Warrants Worksheet (Sheet 5 of 5)

N/A

WARRANT 9 - Intersection Near a Grade Crossing **SATISFIED YES ☐ NO ☐**
(Both Parts A and B Must Be Satisfied)

PART A A grade crossing exists on an approach controlled by a STOP or YIELD sign and the center of the track nearest to the intersection is within 140 feet of the stop line or yield line on the approach. Track Center Line to Limit Line _____ ft	Yes ☐ No ☐
PART B **There is one minor street approach lane at the track crossing -** During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point falls above the applicable curve in Figure 4C-9. Major Street - Total of both approaches: _____ VPH Minor Street - Crosses the track (one direction only, approaching the intersection): _____ VPH X AF (Use Tables 4C-2, 3, & 4 below to calculate AF) = _____ VPH	Yes ☐ No ☐
OR, There are two or more minor street approach lanes at the track crossing - During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point falls above the applicable curve in Figure 4C-10. Major Street - Total of both approaches : _____ VPH Minor Street - Crosses the track (one direction only, approaching the intersection): _____ VPH X AF (Use Tables 4C-2, 3, & 4 below to calcualte AF) = _____ VPH	

The minor street approach volume may be multiplied by up to three following adjustment factors (AF) as described in Section 4C.10.

1- Number of Rail Traffic per Day_____ Adjustment factor from table 4C-2____

2- Percentage of High-Occupancy Buses on Minor Street Approach_____ Adjustment factor from table 4C-3____

3- Percentage of Tractor-Trailer Trucks on Minor Street Approach_____ Adjustment factor from table 4C-4____

NOTE: If no data is availale or known, then use AF = 1 (no adjustment)

APPENDIX F

CALIFORNIA MUTCD

MULTIWAY STOP APPLICATION GUIDELINES:

Standard:

03 **Except as provided in Paragraphs 4 and 5, the minimum sizes for regulatory signs facing traffic on multi-lane conventional roads shall be as shown in the Multi-lane column of Table 2B-1 and 2B-1(CA).**

Option:

04 Where the posted speed limit is 35 mph or less on a multi-lane highway or street, other than for a STOP sign, the minimum size shown in the Single Lane column in Table 2B-1 and 2B-1(CA) may be used.

05 Where a regulatory sign, other than a STOP sign, is placed on the left-hand side of a multi-lane roadway in addition to the installation of the same regulatory sign on the right-hand side or the roadway, the size shown in the Single Lane column in Table 2B-1 and 2B-1(CA) may be used for both the sign on the right-hand side and the sign on the left-hand side of the roadway.

Standard:

06 **A minimum size of 36 x 36 inches shall be used for STOP signs that face multi-lane approaches.**

07 **Where side roads intersect a multi-lane street or highway that has a speed limit of 45 mph or higher, the minimum size of the STOP signs facing the side road approaches, even if the side road only has one approach lane, shall be 36 x 36 inches.**

08 **Where side roads intersect a multi-lane street or highway that has a speed limit of 40 MPH or lower, the minimum size of the STOP signs facing the side road approaches shall be as shown in the Single Lane or Multi-lane columns of Table 2B-1 and 2B-1(CA) based on the number of approach lanes on the side street approach.**

Guidance:

09 *The minimum sizes for regulatory signs facing traffic on exit and entrance ramps should be as shown in the column of Table 2B-1 and 2B-1(CA) that corresponds to the mainline roadway classification (Expressway or Freeway). If a minimum size is not provided in the Freeway column, the minimum size in the Expressway column should be used. If a minimum size is not provided in the Freeway or Expressway Column, the size in the Oversized column should be used.*

Section 2B.04 Right-of-Way at Intersections

Support:

01 State or local laws written in accordance with the "Uniform Vehicle Code" (see Section 1A.11) establish the right-of-way rule at intersections having no regulatory traffic control signs such that the driver of a vehicle approaching an intersection must yield the right-of-way to any vehicle or pedestrian already in the intersection. When two vehicles approach an intersection from different streets or highways at approximately the same time, the right-of-way rule requires the driver of the vehicle on the left to yield the right-of-way to the vehicle on the right. The right-of-way can be modified at through streets or highways by placing YIELD (R1-2) signs (see Sections 2B.08 and 2B.09) or STOP (R1-1) signs (see Sections 2B.05 through 2B.07) on one or more approaches.

Guidance:

02 *Engineering judgment should be used to establish intersection control. The following factors should be considered:*

A. Vehicular, bicycle, and pedestrian traffic volumes on all approaches;
B. Number and angle of approaches;
C. Approach speeds;
D. Sight distance available on each approach; and
E. Reported crash experience.

03 *YIELD or STOP signs should be used at an intersection if one or more of the following conditions exist:*

A. An intersection of a less important road with a main road where application of the normal right-of-way rule would not be expected to provide reasonable compliance with the law;
B. A street entering a designated through highway or street; and/or
C. An unsignalized intersection in a signalized area.

04 *In addition, the use of YIELD or STOP signs should be considered at the intersection of two minor streets or local roads where the intersection has more than three approaches and where one or more of the following conditions exist:*

A. The combined vehicular, bicycle, and pedestrian volume entering the intersection from all approaches averages more than 2,000 units per day;

B. The ability to see conflicting traffic on an approach is not sufficient to allow a road user to stop or yield in compliance with the normal right-of-way rule if such stopping or yielding is necessary; and/or

C. Crash records indicate that five or more crashes that involve the failure to yield the right-of-way at the intersection under the normal right-of-way rule have been reported within a 3-year period, or that three or more such crashes have been reported within a 2-year period.

05 *YIELD or STOP signs should not be used for speed control.*

Support:

06 Section 2B.07 contains provisions regarding the application of multi-way STOP control at an intersection.

Guidance:

07 *Once the decision has been made to control an intersection, the decision regarding the appropriate roadway to control should be based on engineering judgment. In most cases, the roadway carrying the lowest volume of traffic should be controlled.*

08 *A YIELD or STOP sign should not be installed on the higher volume roadway unless justified by an engineering study.*

Support:

09 The following are considerations that might influence the decision regarding the appropriate roadway upon which to install a YIELD or STOP sign where two roadways with relatively equal volumes and/or characteristics intersect:

A. Controlling the direction that conflicts the most with established pedestrian crossing activity or school walking routes;

B. Controlling the direction that has obscured vision, dips, or bumps that already require drivers to use lower operating speeds; and

C. Controlling the direction that has the best sight distance from a controlled position to observe conflicting traffic.

Standard:

10 **Because the potential for conflicting commands could create driver confusion, YIELD or STOP signs shall not be used in conjunction with any traffic control signal operation, except in the following cases:**

A. If the signal indication for an approach is a flashing red at all times;

B. If a minor street or driveway is located within or adjacent to the area controlled by the traffic control signal, but does not require separate traffic signal control because an extremely low potential for conflict exists; or

C. If a channelized turn lane is separated from the adjacent travel lanes by an island and the channelized turn lane is not controlled by a traffic control signal.

10a **STOP signs shall not be erected at any entrance to an intersection controlled by traffic signals. Refer to CVC 21355(a).**

11 **Except as provided in Section 2B.09, STOP signs and YIELD signs shall not be installed on different approaches to the same unsignalized intersection if those approaches conflict with or oppose each other.**

12 **Portable or part-time STOP or YIELD signs shall not be used except for emergency and temporary traffic control zone purposes.**

13 **A portable or part-time (folding) STOP sign that is manually placed into view and manually removed from view shall not be used during a power outage to control a signalized approach unless the maintaining agency establishes that the signal indication that will first be displayed to that approach upon restoration of power is a flashing red signal indication and that the portable STOP sign will be manually removed from view prior to stop-and-go operation of the traffic control signal.**

Option:

14 A portable or part-time (folding) STOP sign that is electrically or mechanically operated such that it only displays the STOP message during a power outage and ceases to display the STOP message upon restoration of power may be used during a power outage to control a signalized approach.

Support:

15 Section 9B.03 contains provisions regarding the assignment of priority at a shared-use path/ roadway intersection.

Section 2B.05 STOP Sign (R1-1) and ALL WAY Plaque (R1-3P)

Standard:

01 **When it is determined that a full stop is always required on an approach to an intersection, a STOP (R1-1) sign (see Figure 2B-1) shall be used.**

02 **The STOP sign shall be an octagon with a white legend and border on a red background.**

03 **Secondary legends shall not be used on STOP sign faces.**

04 **At intersections where all approaches are controlled by STOP signs (see Section 2B.07), an ALL WAY supplemental plaque (R1-3P) shall be mounted below each STOP sign. The ALL WAY plaque (see Figure 2B-1) shall have a white legend and border on a red background.**

05 **The ALL WAY plaque shall only be used if all intersection approaches are controlled by STOP signs.**

06 **Supplemental plaques with legends such as 2-WAY, 3-WAY, 4-WAY, or other numbers of ways shall not be used with STOP signs.**

Support:

07 The use of the CROSS TRAFFIC DOES NOT STOP (W4-4P) plaque (and other plaques with variations of this word message) is described in Section 2C.59.

Guidance:

08 *Plaques with the appropriate alternative messages of TRAFFIC FROM LEFT (RIGHT) DOES NOT STOP (W4-4aP) or ONCOMING TRAFFIC DOES NOT STOP (W4-4bP) should be used at intersections where STOP signs control all but one approach to the intersection, unless the only non-stopped approach is from a one-way street.*

Option:

09 An EXCEPT RIGHT TURN (R1-10P) plaque (see Figure 2B-1) may be mounted below the STOP sign if an engineering study determines that a special combination of geometry and traffic volumes is present that makes it possible for right-turning traffic on the approach to be permitted to enter the intersection without stopping.

Support:

10 The design and application of Stop Beacons are described in Section 4L.05.

11 A STOP (R1-1) sign is not a "cure-all" and is not a substitute for other traffic control devices. Often, the need for a STOP (R1-1) sign can be eliminated if the sight distance is increased by removing obstructions.

Through Highways

Option:

12 STOP (R1-1) signs may be installed either at or near the entrance to a State highway, except at signalized intersections, or at any location so as to control traffic within an intersection. Refer to CVC 21352 and 21355. See Section 1A.11 for information regarding this publication.

Support:

13 When STOP (R1-1) signs or traffic control signals have been erected at all entrances, a highway constitutes a through highway. Refer to CVC 600.

14 Authority to place STOP (R1-1) signs facing State highway traffic is delegated to the Department of Transportation's District Directors.

Option:

15 Local authorities may designate any highway under their jurisdiction as a through highway and install STOP (R1-1) signs in a like manner. Refer to CVC 21354.

Standard:

16 **No local authority shall erect or maintain any STOP (R1-1) sign or other traffic control device requiring a stop, on any State highway, except by permission of the Department of Transportation. Refer to CVC 21353.**

Support:

17 The Department of Transportation will grant such permission only when an investigation indicates that the STOP (R1-1) sign will benefit traffic.

Section 2B.06 STOP Sign Applications

Guidance:

01 *At intersections where a full stop is not necessary at all times, consideration should first be given to using less restrictive measures such as YIELD signs (see Sections 2B.08 and 2B.09).*

02 *The use of STOP signs on the minor-street approaches should be considered if engineering judgment indicates that a stop is always required because of one or more of the following conditions:*

A. The vehicular traffic volumes on the through street or highway exceed 6,000 vehicles per day;

B. A restricted view exists that requires road users to stop in order to adequately observe conflicting traffic on the through street or highway; and/or

C. Crash records indicate that three or more crashes that are susceptible to correction by the installation of a STOP sign have been reported within a 12-month period, or that five or more such crashes have been reported within a 2-year period. Such crashes include right-angle collisions involving road users on the minor-street approach failing to yield the right-of-way to traffic on the through street or highway.

Support:

03 The use of STOP signs at grade crossings is described in Sections 8B.04 and 8B.05.

Section 2B.07 Multi-Way Stop Applications

Support:

01 Multi-way stop control can be useful as a safety measure at intersections if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal.

02 The restrictions on the use of STOP signs described in Section 2B.04 also apply to multi-way stop applications.

Guidance:

03 *The decision to install multi-way stop control should be based on an engineering study.*

04 *The following criteria should be considered in the engineering study for a multi-way STOP sign installation:*

A. Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.

B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.

C. Minimum volumes:

1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and

2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but

3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.

D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.

Option:

05 Other criteria that may be considered in an engineering study include:

A. The need to control left-turn conflicts;

B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;

C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and

D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.